

CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: March 16, 2020

TO: Phillip Spranger – Fitchburg

FROM: Benjamin Hartenbower – WCR/Eau Claire

SUBJECT: Water Quality-Based Effluent Limitations for the Gays Mills Wastewater Treatment Facility
WPDES Permit No. WI-0022268

This is in response to your request for an evaluation of the need for water quality-based effluent limitations (WQBELs) using Chapters NR 102, 104, 105, 106, 207, 210, 212, and 217 of the Wisconsin Administrative Code (where applicable), for the discharge from the Gays Mills Wastewater Treatment Facility in Crawford County. This municipal wastewater treatment facility (WWTF) discharges to the Kickapoo River, located in the Lower Kickapoo River Watershed in the Lower Wisconsin River Basin. The evaluation of the permit recommendations is discussed in more detail in the attached report.

Based on our review, the following recommendations are made on a chemical-specific basis at Outfall 001:

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Six-Month Average	Footnotes
Flow Rate						1,2
BOD ₅			45 mg/L	30 mg/L		1
TSS			45 mg/L	30 mg/L		1
pH	9.0 s.u.	6.0 s.u.				1
Fecal Coliform May – September			656#/100 mL geometric mean	400#/100 mL geometric mean		3
Residual Chlorine	38 µg/L	38 µg/L	38 µg/L			3
Phosphorus Interim Final				3.6 mg/L 0.300 mg/L	0.100 mg/L 0.073 lbs/day	4
Nitrite + Nitrate						5
Nitrogen, Total Kjeldahl						5
Total Nitrogen						5

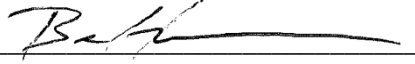
Footnotes:

1. No changes from the current permit
2. Monitoring only
3. Additional limits to comply with the expression of limits requirements in ss. NR 106.07 and NR 205.065(7) are included in bold.
4. If the phosphorus variance application that was submitted is approved by EPA, the existing interim limit of 3.6 mg/L as a monthly average may be extended beyond the end of the compliance schedule along with a requirement for total phosphorus pollutant minimization program.
5. As recommended in the Department's October 1, 2019 Guidance for Total Nitrogen Monitoring in Wastewater Permits, annual total nitrogen (total kjeldahl nitrogen and nitrate/nitrite) monitoring is recommended for all minor municipal permittees. Total Nitrogen is the sum of nitrate (NO₃), nitrite (NO₂), and total kjeldahl nitrogen (all expressed as N).

Following the October 29, 2019 Department's WET Program Guidance Document, no WET testing is required.

Please consult the attached report for details regarding the above recommendations. If there are any questions or comments, please contact Benjamin Hartenbower at (715) 839-3712 (Benjamin.Hartenbower@wisconsin.gov) or Diane Figiel at (608) 264-6274 (Diane.Figiel@wisconsin.gov).

Attachments (3) – Narrative, 2015 Ammonia Calculations, & Map

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Water Quality-Based Effluent Limitations for Gays Mills Wastewater Treatment Facility

WPDES Permit No. WI-0022268

Prepared by: Benjamin P. Hartenbower

PART 1 – BACKGROUND INFORMATION

Facility Description:

Gays Mills Wastewater Treatment Facility treats domestic waste from the Village of Gays Mills. The facility has an annual average design flow of 0.087 million gallons per day (MGD). The treatment facility has screening, contact stabilization, activated sludge and aerobic digestion. Effluent is disinfected seasonally via chlorination prior to discharge to the east bank of the Kickapoo River, ½ mile south of the Highway 171 bridge. Sludge is landspread on Department approved fields.

Attachment #3 is a map of the area showing the approximate location of Outfall 001.

Existing Permit Limitations: The current permit, expiring on June 30, 2020 includes the following effluent limitations and monitoring requirements.

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Six-Month Average	Footnotes
Flow Rate						1,2
BOD ₅			45 mg/L	30 mg/L		1
TSS			45 mg/L	30 mg/L		1
pH	9.0 s.u.	6.0 s.u.				1
Fecal Coliform May – September				400#/100 mL geometric mean		
Residual Chlorine	38 µg/L					
Phosphorus Interim Final				3.6 mg/L 0.300 mg/L	0.100 mg/L 0.073 lbs/day	3

Footnotes:

1. These limitations are not being evaluated as part of this review. Because the water quality criteria (WQC), reference effluent flow rates, and receiving water characteristics have not changed, limitations for these water quality characteristics do not need to be re-evaluated at this time.
2. Monitoring only
3. This is an interim limit. The final WQBELs are 0.100 mg/L as six-month average and 0.300 mg/L as a monthly average. A compliance schedule is in the current permit to meet the final WQBEL by July 1, 2024.

Receiving Water Information:

- Name: Kickapoo River
- Classification used in accordance with chs. NR 102 and 104, Wis. Adm. Code: Warm water sport fish community, non-public water supply.
- Low Flows used in accordance with chs. NR 106 and 217, Wis. Adm. Code: The following 7-Q₁₀ and 7-Q₂ values are from USGS for Station 05410000, at Gays Mills, State Highway 171 in the Kickapoo River, where Outfall 001 is located.
 - 7-Q₁₀ = 156 cfs (cubic feet per second)
 - 7-Q₂ = 210 cfs
 - Harmonic Mean Flow = cfs using a drainage area of 617 mi²
- Hardness = 243.3 mg/L as CaCO₃. This value represents the geometric mean of data from the Kickapoo River at Steuben
- % of low flow used to calculate limits in accordance with s. NR 106.06 (4) (c) 5., Wis. Adm. Code: 25%
- Source of background concentration data: Metals data from the Kickapoo River at Oil City is used for this evaluation. The numerical values are shown in the tables below. If no data is available, the background concentration is assumed to be negligible and a value of zero is used in the computations. Background data for calculating effluent limitations for ammonia nitrogen are described later.
- Multiple dischargers: There are several other dischargers to the Kickapoo River however they are not in the immediate vicinity and the mixing zones do not overlap. Therefore, the other dischargers do not impact this evaluation.
- Impaired water status: The Kickapoo River is listed as impaired for Mercury (19.05 to 25.45 mile) and Total Phosphorus (19.05 to 25.45 mile and 61.03 to 119.4 mile)

Effluent Information:

- Design Flow Rate(s):
 - Annual average = 0.087 MGD (Million Gallons per Day)

For reference, the actual average flow from July 2015 to January 2020 was 0.073 MGD.

- Hardness = 321 mg/L as CaCO₃. This value represents the geometric mean of data submitted with the permit application from four samples collected 8/6/2019 to 8/27/2019.
- Acute dilution factor used in accordance with s. NR 106.06 (3) (c), Wis. Adm. Code: Not applicable – this facility does not have an approved Zone of Initial Dilution (ZID).
- Water Source: Domestic wastewater with water supply from wells
- Additives: sodium hypochlorite (biocide) and sodium bisulfite (dechlorination)
- Effluent characterization: This facility is categorized as a minor municipality, so the permit application required effluent sample analyses for a limited number of common pollutants, as specified in s. NR 200.065, Table 1, Wis. Adm. Code, primarily metal substances plus Ammonia, Chloride and Hardness. The permit-required monitoring for Phosphorus from July 2015 to January 2020 is used in this evaluation.

Attachment #1

Sample Date	Copper µg/L	Chloride mg/L
08/06/2019	6.53	126
08/13/2019	8.25	123
08/20/2019	6.91	122
08/27/2019	25.2	112
09/03/2019	7.66	
09/10/2019	8.32	
09/17/2019	5.00	
09/24/2019	4.25	
10/01/2019	4.21	
10/11/2019	5.48	
10/15/2019	8.34	
1-day P ₉₉	29.7	
4-day P ₉₉	17.3	

The following table presents the average concentrations and loadings at Outfall 001 from July 2015 to January 2020 for all parameters with limits in the current permit to meet the requirements of s. NR 201.03(6):

	Average Measurement
BOD ₅	3.6 mg/L*
TSS	6.9 mg/L*
pH field	6.98 s.u.
Phosphorus	2.02 mg/L
Fecal Coliform	348 #/100 mL
Chlorine	<10 µg/L

*Results below the level of detection (LOD) were included as zeroes in calculation of average.

Effluent data for substances for which a single sample was analyzed is shown in the tables in Part 2 below, in the column titled “MEAN EFFL. CONC.”.

PART 2 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR TOXIC SUBSTANCES – EXCEPT AMMONIA NITROGEN

Permit limits for toxic substances are required whenever any of the following occur:

1. The maximum effluent concentration exceeds the calculated limit (s. NR 106.05(3), Wis. Adm. Code)
2. If 11 or more detected results are available in the effluent, the upper 99th percentile (or P₉₉) value exceeds the comparable calculated limit (s. NR 106.05(4), Wis. Adm. Code)
3. If fewer than 11 detected results are available, the mean effluent concentration exceeds 1/5 of the calculated limit (s. NR 106.05(6), Wis. Adm. Code)

Acute Limits based on 1-Q₁₀

Daily maximum effluent limitations for toxic substances are based on the acute toxicity criteria (ATC), listed in ch. NR 105, Wis. Adm. Code. Previously daily maximum limits for toxic substances were calculated as two times the ATC. However, changes to ch. NR 106, Wis. Adm. Code (September 1, 2016) require the Department to calculate acute limitations using the same mass balance equation as used for other limits along with the 1-Q₁₀ receiving water low flow to determine if more restrictive effluent limitations are needed to protect the receiving stream from discharges which may cause or contribute to an exceedance of the acute water quality standards.

$$\text{Limitation} = \frac{(\text{WQC}) (Q_s + (1-f) Q_e) - (Q_s - f Q_e) (C_s)}{Q_e}$$

Where:

WQC = Acute toxicity criterion or secondary acute value according to ch. NR 105

Q_s = average minimum 1-day flow which occurs once in 10 years (1-day Q₁₀)

if the 1-day Q₁₀ flow data is not available = 80% of the average minimum 7-day flow which occurs once in 10 years (7-day Q₁₀).

Q_e = Effluent flow (in units of volume per unit time) as specified in s. NR 106.06(4)(d), Wis. Adm. Code.

f = Fraction of the effluent flow that is withdrawn from the receiving water, and

C_s = Background concentration of the substance (in units of mass per unit volume) as specified in s. NR 106.06(4)(e), Wis. Adm. Code.

As a rule of thumb, if the receiving water is effluent dominated under low stream flow conditions, the 1-Q₁₀ method of limit calculation produces the most stringent daily maximum limitations and should be used while making reasonable determinations. This is not the case for the Gays Mills Wastewater Treatment Facility and the limits are set based on two times the acute toxicity criteria.

The following tables list the calculated water quality-based effluent limitations for this discharge along with the results of effluent sampling for all the detected substances. All concentrations are expressed in terms of micrograms per Liter (µg/L), except for hardness and chloride (mg/L).

Daily Maximum Limits based on Acute Toxicity Criteria (ATC)

RECEIVING WATER FLOW = 124.8 cfs, (1-Q₁₀ (estimated as 80% of 7-Q₁₀)), as specified in s. NR 106.06 (3) (bm), Wis. Adm. Code.

SUBSTANCE	REF. HARD.* mg/L	ATC	MAX. EFFL. LIMIT**	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	1-day P ₉₉	1-day MAX. CONC.
Chlorine		19.0	38.1				
Arsenic		340	679.6	135.9	0.87		
Cadmium	321	39.3	78.5	15.7	<0.067		
Chromium	301	4446	8891.7	1778	<0.92		
Copper	321	46.6	93.2			29.72	25.20
Lead	321	330	659.5	131.9	<0.72		
Nickel	268	1080	2160.6	432	2.83		
Zinc	321	334	667.2	133.4	<30		
Chloride (mg/L)		757	1514.0	303	120.75		

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* The indicated hardness may differ from the effluent hardness because the effluent hardness exceeded the maximum range in ch. NR 105, Wis. Adm. Code, over which the acute criteria are applicable. In that case, the maximum of the range is used to calculate the criterion.

* * The $2 \times$ ATC method of limit calculation yields a more restrictive limit than consideration of ambient concentrations and 1-Q₁₀ flow rates per the changes to s. NR 106.07(3), Wis. Adm. Code, effective 09/01/2016.

Weekly Average Limits based on Chronic Toxicity Criteria (CTC)

RECEIVING WATER FLOW = 39.0 cfs (¼ of the 7-Q₁₀), as specified in s. NR 106.06 (4) (c), Wis. Adm. Code

SUBSTANCE	REF. HARD.* mg/L	CTC	MEAN BACK- GRD.	WEEKLY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	4-day P ₉₉
Chlorine		7.28		2116			
Arsenic		152.2		44248	8850	0.87	
Cadmium	175	3.82	0.025	1103	220.7	<0.067	
Chromium	243	273.64	0.836	79311	15862	<0.92	
Copper	243	22.15	1.093	6123			17.29
Lead	243	66.12	0.950	18947	3789	<0.72	
Nickel	243	110.74		32194	6439	2.83	
Zinc	243	261.95	2.935	75304	15061	<30	
Chloride (mg/L)		395		114835	22967	120.75	

* The indicated hardness may differ from the receiving water hardness because the receiving water hardness exceeded the maximum range in ch. NR 105, Wis. Adm. Code, over which the chronic criteria are applicable. In that case, the maximum of the range is used to calculate the criterion.

Monthly Average Limits based on Wildlife Criteria (WC)

The effluent characterization did not include any effluent sampling results for substances for which Wildlife Criteria exist.

Monthly Average Limits based on Human Threshold Criteria (HTC)

RECEIVING WATER FLOW = 77.9 cfs (¼ of Harmonic Mean), as specified in s. NR 106.06 (4), Wis. Adm. Code.

SUBSTANCE	HTC	MEAN BACK- GRD.	MO'LY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.
Cadmium	370	0.025	214394	42879	<0.067
Chromium (+3)	3818000	0.836	2212462856	442492571	<0.92
Lead	140	0.950	80578	16116	<0.72
Nickel	43000		24917738	4983548	2.83

Monthly Average Limits based on Human Cancer Criteria (HCC)

RECEIVING WATER FLOW = 77.9 cfs (¼ of Harmonic Mean), as specified in s. NR 106.06 (4), Wis. Adm. Code.

SUBSTANCE	HCC	MEAN BACK- GRD.	MO'LY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.
Arsenic	13.3		7707	1541	0.87

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In addition to evaluating the need for limits for each individual substance for which HCC exist, s. NR 106.06(8), Wis. Adm. Code, requires the evaluation of the cumulative cancer risk. Because only one substance for which Human Cancer Criteria exists was detected, determination of the cumulative cancer risk is not needed per s. NR 106.06(8), Wis. Adm. Code.

Conclusions and Recommendations: Based on a comparison of the effluent data and calculated effluent limitations, effluent limitations are required for chlorine.

Total Residual Chlorine – Because chlorine is added as a disinfectant, effluent limitations are recommended to assure proper operation of the de-chlorination system. Section NR 210.06(2)(b) , Wis. Adm. Code, states, “When chlorine is used for disinfection, the daily maximum total residual chlorine concentration of the discharge may not exceed 0.10 mg/L.” Because the WQBELs are more restrictive, they are recommended instead. Specifically, a daily maximum limit of 38 µg/L (38.06, rounded to two significant figures) is required. Due to revisions to s. NR 106.07(2) , Wis. Adm. Code, mass limitations are no longer required. Weekly average limitations are not needed based on reasonable potential as the daily maximum limitations will provide adequate protection of the resource however additional limits are discussed in the expression of limits section of this memo.

Mercury – The permit application did not require monitoring for mercury because the Gays Mills Wastewater Treatment Facility is categorized as a minor facility as defined in s. NR 200.02(8), Wis. Adm. Code. In accordance with s. NR 106.145(3)(a)3., Wis. Adm. Code, a minor municipal discharger shall monitor, and report results of influent and effluent mercury monitoring once every three months if, “there are two or more exceedances in the last five years of the high-quality sludge mercury concentration of 17 mg/kg specified in s. NR 204.07(5).” A review of the past five years of sludge characteristics data reveals that all the sample results are within expected analytical ranges and well below the 17 mg/kg level. The concentration in the sludge from 2018 was 5.75 mg/kg. Therefore, no mercury monitoring is recommended at Outfall 001.

PART 3 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR AMMONIA NITROGEN

The State of Wisconsin promulgated revised water quality standards for ammonia nitrogen in ch. NR 105, Wis. Adm. Code, effective March 1, 2004 which includes criteria based on both acute and chronic toxicity to aquatic life. Given the fact that the Gays Mills Wastewater Treatment Facility does not currently have ammonia nitrogen limits the need for limits is evaluated at this time.

Daily Maximum Limits based on Acute Toxicity Criteria (ATC):

Daily maximum limitations are based on acute toxicity criteria in ch. NR 105, Wis. Adm. Code, which are a function of the effluent pH and the receiving water classification. The acute toxicity criterion (ATC) for ammonia is calculated using the following equation.

$$\text{ATC in mg/L} = [A \div (1 + 10^{(7.204 - \text{pH})})] + [B \div (1 + 10^{(\text{pH} - 7.204)})]$$

Where:

A = 0.411 and B = 58.4 for a Warm Water Sport fishery, and
pH (s.u.) = that characteristic of the effluent.

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The effluent pH data was examined as part of this evaluation. A total of 1662 sample results were reported from July 2015 to January 2020. The maximum reported value was 7.10 s.u. (Standard pH Units). The effluent pH was 7.00 s.u. or less 99% of the time. The 1-day P_{99} , calculated in accordance with s. NR 106.05(5), Wis. Adm. Code, is 7.08 s.u. and the mean plus the standard deviation multiplied by a factor of 2.33, an estimate of the upper ninety ninth percentile for a normally distributed dataset, is 7.08 s.u. Therefore, a value of 7.08 s.u. is believed to represent the maximum reasonably expected pH, and therefore most appropriate for determining daily maximum limitations for ammonia nitrogen. Substituting a value of 7.08 s.u. into the equation above yields an ATC = 33.56 mg/L.

Potential changes to daily maximum Ammonia Nitrogen effluent limitations:

Subchapter IV of ch. NR 106, Wis. Adm. Code (effective September 1, 2016) specifies methods for the use of the 1- Q_{10} receiving water low flow to calculate daily maximum ammonia nitrogen limits if it is determined that the previous method of acute ammonia limit calculation ($2 \times \text{ATC}$) is not sufficiently protective of the fish and aquatic life. The more restrictive calculated limits shall apply.

The calculated daily maximum ammonia nitrogen effluent limits using the mass balance approach with the 1- Q_{10} (estimated as 80 % of 7- Q_{10}) and the $2 \times \text{ATC}$ approach are shown below.

	Ammonia Nitrogen Limit mg/L
$2 \times \text{ATC}$	67.11
1- Q_{10}	31,065

The $2 \times \text{ATC}$ method yields the most stringent limits for the Gays Mills Wastewater Treatment Facility.

Weekly and Monthly Average Limits based on Chronic Toxicity Criteria (CTC)

Weekly and monthly average limits are not included in the current permit but are being evaluated here due to changes to ch. NR 106. **The weekly and monthly average ammonia nitrogen limits calculation from the previous memo do not change** because there have been no changes in the effluent and receiving water flow rates. The calculations from the previous WQBEL memo are shown in attachment #2.

Effluent Data

Four samples for ammonia nitrogen were taken in August 2019, and their results were as follows:

Sample Date	Ammonia Nitrogen mg/L
08/06/2019	<0.07
08/13/2019	<0.07
08/20/2019	<0.07
08/27/2019	3.62

Conclusions and Recommendations:

In summary, ammonia nitrogen limitations are not recommended. The highest ammonia result of 3.62 mg/L is well below the calculated daily max of 67 mg/L and all seasonal weekly and monthly limits.

Attachment #1
PART 4 – PHOSPHORUS

Technology Based Phosphorus Limit

Subchapter II of Chapter NR 217, Wis. Adm. Code, requires municipal wastewater treatment facilities that discharge greater than 150 pounds of Total Phosphorus per month to comply with a monthly average limit of 1.0 mg/L, or an approved alternative concentration limit.

Because the Gays Mills Wastewater Treatment Facility does not currently have an existing technology-based limit, the need for this limit in the reissued permit is evaluated. The data demonstrates that the annual monthly average phosphorus loading is less than 150 lbs/month, which is the threshold for municipalities in accordance to s. NR 217.04 (1) (a) 1, Wis. Adm. Code, and therefore a technology-based limit is not required.

Month	Monthly Avg. mg/L	Total Flow MG/month	Total Phosphorus lb./mo.
Feb 2019	1.10	1.72	15.7
Mar 2019	0.84	3.73	26.2
April 2019	0.92	2.64	20.3
May 2019	1.36	2.64	30.0
June 2019	1.72	2.30	33.0
July 2019	1.27	3.90	41.3
Aug 2019	2.20	2.13	39.0
Sept 2019	1.63	3.50	47.6
Oct 2019	1.25	3.90	40.8
Nov 2019	1.43	2.45	29.2
Dec 2019	1.33	2.38	26.3
Jan 2020	1.60	2.02	27.0
Average =			31.4

Total P (lbs/month) = Monthly average (mg/L) × total flow (MG/month) × 8.34 (lbs/gallon)
Where total flow is the sum of the actual (not design) flow (in MGD) for that month

In addition, the need for a WQBEL for phosphorus must be considered.

Water Quality-Based Effluent Limits (WQBEL)

Revisions to administrative rules regulating phosphorus took effect on December 1, 2010. These rule revisions include additions to s. NR 102.06, Wis. Adm. Code, which establish phosphorus standards for surface waters. Subchapter III of NR 217, Wis. Adm. Code, establishes procedures for determining WQBELs for phosphorus, based on the applicable standards in ch. NR 102, Wis. Adm. Code.

Section NR 102.06(3)(a), Wis. Adm. Code, specifically names river segments for which a phosphorus criterion of 0.100 mg/L applies. For other stream segments that are not specified in s. NR 102.06(3)(a), Wis. Adm. Code, s. NR 102.06(3)(b), Wis. Adm. Code, specifies a phosphorus criterion of 0.075 mg/L. The phosphorus criterion of 0.100 mg/L applies for the Kickapoo River.

The conservation of mass equation is described in s. NR 217.13 (2)(a), Wis. Adm. Code, for phosphorus WQBELs and includes variables of water quality criterion (WQC), receiving water flow rate (Qs), effluent flow rate (Qe), and upstream phosphorus concentrations (Cs):

$$\text{Limitation} = [(WQC)(Q_s + (1-f) Q_e) - (Q_s - f Q_e) (C_s)] / Q_e$$

Where:

WQC = 0.100 mg/L for the Kickapoo River.

Q_s = 100% of the 7-Q₂ of 210 cfs

C_s = background concentration of phosphorus in the receiving water pursuant to s. NR 217.13(2)(d), Wis. Adm. Code

Q_e = effluent flow rate = 0.087 MGD = 0.135 cfs

f = the fraction of effluent withdrawn from the receiving water = 0

Section NR 217.13(2)(d), Wis. Adm. Code, specifies that the background phosphorus concentration used in the limit calculation formula shall equal the median of at least four samples collected during the months of May through October, and that all samples collected during a 28-day period shall be considered as a single sample and the average of these concentrations used to determine a median. Averaging begins at date of the first sample in the range of May through October.

A previous evaluation resulted in a WQBEL of 0.100 mg/L using a background concentration above the criterion. Section NR 217.13(2)(d), Wis. Adm. Code, states that the determination of upstream concentrations shall be evaluated at each permit reissuance. Additional data were considered in estimating the background phosphorus concentration.

In stream total phosphorus data from the Kickapoo River were considered in estimating the background phosphorus concentration:

SWIMS ID	533027	10029649
	Monitoring station at	Monitoring station at
	Kickapoo River- Banker	Kickapoo River- 100 ft
Station Name	Park in Viola	N of Hwy 131 (St.1)
Waterbody	Kickapoo River	Kickapoo River
Sample Count	6	12
First Sample	10/28/2009	05/17/2015
Last Sample	09/06/2010	10/16/2016
Mean	0.215 mg/L	0.136 mg/L
Median	0.186 mg/L	0.118 mg/L
NR 217 Median	0.221 mg/L	0.118 mg/L

Substituting a background concentration above the criterion into the limit calculation equation above would result in a calculated limit that is less than the applicable criterion of 0.100 mg/L. However, s. NR 217.13(7), Wis. Adm. Code, specifies that “if the water quality-based effluent limitation calculated pursuant to the procedures in this section is less than the phosphorus criterion specified in s. NR 102.06, Wis. Adm. Code, for the water body, the effluent limit shall be set equal to the criterion.”

The impaired water listing of the Kickapoo River from stream miles 19.05-25.45 also points towards the notion that effluent phosphorus limits equal to the water quality criterion are needed to prevent the discharge from contributing to further impairment of the receiving water. Available guidance suggests setting effluent limits equal to the criterion in the absence of an EPA approved total maximum daily load for discharges of phosphorus to phosphorus impaired waters.

Effluent Data

The following table summarizes effluent total phosphorus monitoring data from July 2015 to January 2020.

	Phosphorus mg/L
1-day P ₉₉	5.8
4-day P ₉₉	3.6
30-day P ₉₉	2.54
Mean	2.02
Std	1.10
Sample size	234
Range	0.081 - 5.6

Reasonable Potential Determination

Since the 30-day P₉₉ of reported effluent total phosphorus data is greater than the calculated WQBEL, **the discharge has reasonable potential to cause or contribute to an exceedance of the water quality criterion. Therefore, a WQBEL is required.**

Limit Expression

According to s. NR 217.14 (2), Wis. Adm. Code, because the calculated WQBEL is less than or equal to 0.3 mg/L, the effluent limit of 0.100 mg/L may be expressed as a six-month average. If a concentration limitation expressed as a six-month average is included in the permit, a monthly average concentration limitation of 0.300 mg/L, equal to three times the WQBEL calculated under s. NR 217.13, Wis. Adm. Code shall also be included in the permit. The six-month average should be averaged during the months of May – October and November – April.

Mass Limits

Because the discharge is to a surface water that is impaired for total phosphorus, a mass limit is also required, pursuant to s. NR 217.14(1)(a), Wis. Adm. Code. **This final mass limit shall be 0.100 mg/L × 8.34 × 0.087 MGD = 0.073 lbs/day expressed as a six-month average.**

Variance Request

The existing permit includes a 7 to 9 year compliance schedule to meet the final WQBEL by July 1, 2022 or 2024. The interim limit of 3.6 mg/L is applicable until the end of this compliance schedule. The facility has applied for an individual variance under s. 283.15, Wis. Stats. Eligibility for the variance is not included as part of this review. If a variance is granted and approved by US Environmental Protection Agency, **the current interim limit of 3.6 mg/L may be extended beyond the end of the compliance schedule.**

Attachment #1
PART 5 – THERMAL

Surface water quality standards for temperature took effect on October 1, 2010. These regulations are detailed in chs. NR 102 (Subchapter II – Water Quality Standards for Temperature) and NR 106 (Subchapter V – Effluent Limitations for Temperature) of the Wisconsin Administrative Code. Daily maximum and weekly average temperature criteria are available for the 12 different months of the year depending on the receiving water classification.

Due to the amount of upstream flow available for dilution in the limit calculation ($Q_s:Q_e > 20:1$), the lowest calculated limitation is 120° F (s. NR 106.55(6)(a), Wis. Adm. Code). For activated sludge treatment systems of domestic waste, there is no reasonable potential for the discharge to exceed this limit, therefore temperature limits and monitoring are not recommended.

PART 6 – WHOLE EFFLUENT TOXICITY (WET)

WET testing is used to measure, predict, and control the discharge of toxic materials that may be harmful to aquatic life. In WET tests, organisms are exposed to a series of effluent concentrations for a given time and effects are recorded. Decisions below related to the selection of representative data and the need for WET limits were made according to ss. NR 106.08 and 106.09, Wis. Adm. Code. WET monitoring frequency and toxicity reduction evaluation (TRE) recommendations were made using the best professional judgment of staff familiar with the discharge after consideration of the guidance in the WET Program Guidance Document (October 29, 2019).

- Chronic testing is usually not recommended where the ratio of the 7-Q₁₀ to the effluent flow exceeds 100:1 and acute testing is not typically recommended if the ratio exceeds 1000:1. For the Gays Mills Wastewater Treatment Facility, that ratio is approximately 1159:1. With this amount of dilution, there is believed to be little potential for acute or chronic toxicity effects in the Kickapoo River associated with the discharge from the Gays Mills Wastewater Treatment Facility, so the need for acute and chronic WET testing will not be considered further.

PART 7 – EXPRESSION OF LIMITS

Revisions to chs. NR 106 and 205, Wis. Adm. Code align Wisconsin's water quality-based effluent limits with 40 CFR 122.45(d), which requires WPDES permits contain the following concentration limits, whenever practicable and necessary to protect water quality:

- Weekly average and monthly average limitations for continuous discharges subject to ch. NR 210.
- Daily maximum and monthly average limitations for all other discharges.

The Gays Mills Wastewater Treatment Facility is a municipal treatment facility and is therefore subject to weekly average and monthly average limitations whenever limitations are determined to be necessary.

This evaluation provides additional limitations necessary to comply with the expression of limits in ss. NR 106.07 and NR 205.065(7), Wis. Adm. Code. Pollutants already compliant with these rules or that have an approved impracticability demonstration, are excluded from this evaluation including water-quality based effluent limitations for phosphorus, temperature, and pH, among other parameters. Mass limitations are not subject to the limit expression requirements if concentrations limits are given.

Method for calculation:

The methods for calculating limitations for continuous discharges subject to ch. NR 210 to conform to 40 CFR 122.45(d) are specified in s. NR 106.07(3), Wis. Adm. Code, and are as follows:

1. Whenever a daily maximum limitation is determined necessary to protect water quality, a weekly and monthly average limitation shall also be included in the permit and set equal to the daily maximum limit unless a more restrictive limit is already determined necessary to protect water quality.
 - Weekly and monthly average limitations for chlorine are recommended to be set equal to the daily maximum limitation of 38 µg/L.
2. Whenever a weekly average limitation is determined necessary to protect water quality, a monthly average limitation shall also be included in the permit and set equal to the weekly average limit unless a more restrictive limit is already determined necessary to protect water quality.
3. Whenever a monthly average limitation is determined necessary to protect water quality, a weekly average limit shall be calculated using the following procedure and included in the permit unless a more restrictive limit is already determined necessary to protect water quality:

$$\text{Weekly Average Limitation} = (\text{Monthly Average Limitation} \times \text{MF})$$

Where:

MF= Multiplication factor as defined in Table 1

CV= coefficient of variation (CV) as calculated in s. NR 106.07(5m)

n= the number of samples per month required in the permit

s. NR 106.07 (3) (e) 4. Table 1 — Multiplication Factor (for CV = 0.6)

CV	n=1	n=2	n=3	n=4	n=8	n=12	n=16	n=20	n=24	n=30
0.6	1.00	1.31	1.51	1.64	1.95	2.12	2.23	2.30	2.36	2.43

Note: This methodology is based on the *Technical Support Document for Water Quality-based Toxics Control* (March 1991). PB91-127415.

- A weekly geometric mean fecal coliform limit of 656#/100mL is recommended in the permit. This limit is calculated using the default CV of 0.6 and multiplication factor of 1.64 based on an assumed weekly monitoring frequency.

Summary of Additional Limitations:

In conclusion, the following additional limitations are required to comply with ss. NR 106.07 and NR 205.065(7) Expression of Limits.

Parameter	Daily Maximum	Weekly Average	Monthly Average	Weekly Geometric Mean	Monthly Geometric Mean	Multiplication Factor (CV)	Assumed Monitoring Frequency (n)
Fecal Coliform				656#/100 mL geometric mean	400#/100 mL geometric mean	1.64 (0.6)	Weekly (4)
Chlorine	38 µg/L	38 µg/L	38 µg/L				

Ammonia Nitrogen Limit Calculations from the February 20, 2015 WQBEL Memo

Effluent Flow (mgd):	0.087
Effluent Flow (cfs):	0.135

Effluent pH data:	
Begin Date	01-Jan-12
End Date	31-Dec-14
# of Samples	1095
Maximum	7.1
Average	7.04
Standard Deviation	0.054
Estimated 99th Percentile	7.17
Max. Effluent pH (s.u.):	7.20

BACKGROUND INFORMATION:

	<i>summer</i>	<i>winter</i>	<i>spring</i>	<i>fall</i>
4Q3 (cfs)				
7Q10 (cfs)	156	156		
30Q5 (cfs)				
7Q2 (cfs)	210	210		
Ammonia (mg/L) (1)	0.05	0.12		
Temperature (deg C) (2)	25	3		
pH (std. units) (3)	7.87	7.51		
% of river flow used:	100	25		
Reference weekly flow:	156	39		
Reference monthly flow:	178.5	44.6		

CRITERIA (in mg/L):

Acute (@ effl. pH):	29.54	29.54
4-day Chronic (@ backgrd. pH):		
early life stages present	3.70	10.81
early life stages absent	3.70	17.56
30-day Chronic (@ backgrd. pH)		
early life stages present	1.48	4.33
early life stages absent	1.48	7.02

EFFLUENT LIMITS (in mg/L):

Daily maximum	59	59
Weekly average		
early life stages present	4237	3109
early life stages absent		5070
Monthly average		
early life stages present	1899	1399
early life stages absent		2296

(1) Default Data
(2) Default Data
(3) Default Data

Attachment #3

